

# इंटरनेट

# मानक

## Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 5968 (1987): Guide for planning and layout of canal system for irrigation [WRD 13: Canals and Cross Drainage Works]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



BLANK PAGE



*Indian Standard*

GUIDE FOR PLANNING AND LAYOUT OF  
CANAL SYSTEM FOR IRRIGATION

( *First Revision* )

UDC 626.82 (026)

© Copyright 1987

BUREAU OF INDIAN STANDARDS  
MANAK BHAVAN, 9 BHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

# Indian Standard

## GUIDE FOR PLANNING AND LAYOUT OF CANAL SYSTEM FOR IRRIGATION

(First Revision )

Irrigation Canals and Canal Linings Sectional Committee, BDC 57

### Chairman

SHRI J. K. DHIR

### Representing

Punjab State Tubewell Corporation Ltd,  
Chandigarh

### Members

SHRI M. S. BRAR (Alternate to  
Shri J. K. Dhir)

SHRI RAVINDER KUMAR AGAGRWAL Irrigation Department, Government of Uttar  
Pradesh, Lucknow

SHRI RAJNI KANT ( Alternate )

SHRI N. C. BHATNAQAR

Central Ground Water Board, New Delhi

SHRI R. K. PRASAD (Alternate )

SHRI RAGHUVVEER CHANDER

Irrigation & Power Department, Government of  
Andhra Pradesh, Hyderabad  
Roorkee University, Roorkee

DR A. S. CHAWLA

DR R. J. GARDE ( Alternate )

CHIEF ENGINEER ( LINING )

Irrigation Works, Government of Punjab,  
Chandigarh

DIRECTOR ( CANALS ) ( Alternate )

CHIEF ENGINEER ( RESEARCH )

Irrigation Research Institute, Khauagaul ( Patna )

CHIEF ENGINEER IRRIGATION Public Works Department, Government of  
( SOUTH ) Karnataka, Bangalore

CHIEF ENGINEER ( Alternate )

CHIEF ENGINEER ( SP )

Irrigation Department, Government of  
Maharashtra, Bombay

SHRI J. H. NARORE ( Alternate )

SHRI P. A. DANDEKAR

Union Carbide India Ltd, Bombay

SHRI PRADEEP KUMAR ( Alternate )

SHRI O. P. DATTA

Bhakra Beas Management Board, Chandigarh

SHRI S. P. JAIN ( Alternate )

SHRI N. K. DIKAHIT

Planning Commission, New Delhi

SHRI A. S. GUPTA ( Alternate )

( Continued on page 2 )

© Copyright 1987

BUREAU OF INDIAN STANDARDS

This publication is protected under the *Indian Copyright Act* ( XIV of 1957 ) and reproduction in whole or in part by any means except with writtrn permission of the publisher shall be deemed to be an infringement of copyright under the said Act

## IS : 5968 - 1987

( Continued from page 1 )

Members	Representing
DIRECTOR	Maharashtra Engineering Research Institute, Nasik
RESEARCH OFFICER ( Alternate )	
DIRECTOR	Central Water & Power Research Station, Pune
SHRI M. L. GODBOLE ( Alternate )	
DIRECTOR	Irrigation Department, Government of Rajasthan, Jaipur
DIRECTOR ( BCD-II )	Central Water Commission, New Delhi
DEPUTY DIRECTOR ( BCD-II ) ( Alternate )	
SHRI H. N. GANDHI	Harpana State Minor Irrigation ( Tubewells ) Corporation Ltd, Chandigarh
SHRI R. K. CHADHA ( Alternate )	
SHRI H. K. KHOSLA	Irrigation & Power Department, Government of Haryana, Chandigarh
SUPERINTENDING ENGINEER ( Alternate )	
SPECIAL CHIEF ENGINEER	Public Works Department, Tamil Nadu, Madras
SENIOR DEPUTY CHIEF ENGINEER ( IRRIGATION ) ( Alternate )	
SHRI C. D. THATTE	Irrigation Department, Government of Gujarat, Gandhinagar
SHRI K. B. SHAH ( Alternate )	
SHRI C. V. J. VERMA	Central Board of Irrigation and Power, New Delhi
SHRI K. R. SAXENA ( Alternate )	
SHRI G. RAMAN, Director ( Civ Engg )	Director General, BIS ( <i>Ex-officio Member</i> )

Secretary

SHRI HEMANT KUMAR  
Deputy Director (Civ Engg ), BIS

# *Indian Standard*

## GUIDE FOR PLANNING AND LAYOUT OF CANAL SYSTEM FOR IRRIGATION

### ( *First Revision* )

#### 0. FOREWORD

0.1 This Indian Standard ( First Revision ) was adopted by the Indian Standards Institution on 30 January 1987, after the draft finalized by the Irrigation Canals and Canal Linings Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The planning and layout of a canal system is controlled by the area to be irrigated and the source of supply. The layout of main canals and branches is generally fixed on the consideration of economy. For the layout of distributaries and minors, points of offtake may be suitably selected but their layout is more or less governed by the blocks of areas to be irrigated taking into consideration the watersheds and drainages. The main canals and branches are feeder channels for distributaries and generally no irrigation is done directly from them. Irrigation outlets are provided on distributaries or minors offcaking from distributaries.

0.2.1 The stage for general planning and layout of canal system arises after the general feasibility of the project has been established.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS :2-1960\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

0.4 This standard was first published in 1970. This revision has been prepared in the light of experience gained in the usage of the standard during course of these years. In this revision a number of changes have been made; the prominent among which are:

- a) Addition of radii of curves for lined canals with low discharges.
- b) Revision of proforma for capacity of statement of a canal.

---

**\*Rules for rounding off numerical values ( revised ).**

## 1. SCOPE

1.1 This standard covers planning and layout of canal system for irrigation.

**NOTE — This standard does not cover power canals, navigation canals and the lift stage of a proposed canal system.**

## 2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 4410 ( Part 1 )-1967\* and IS : 4410 ( Part 5 )-1968† and the following shall apply.

2.1.1 *Branch Canal* — A canal receiving its supply from the main canal and acting as feeder for distributaries. It is also called 'Lateral'.

**2.1.2 *Contour Canal*** -- Canal conforming generally to the contours of the country traversed having, however, such slope as is necessary to produce required velocity of flow.

**2.1.3 *Crop Ratio*** — The crop ratio is defined as the ratio of areas under different crops to be irrigated during a year.

2.1.4 *Culturable Commanded Area* — The gross area commanded minus the area of unculturable land included in the gross area.

2.1.5 *Distributary* — A channel receiving its supply from the main canal or branch canal. It supplies water to minors and water-courses. It is called 'major distributary' when it supplies water to another distributary called a 'minor distributary'.

2.1.6 *Duty or Duty of Water* -- The relation between the area irrigated, or to be irrigated, and the quantity of water used, or required, to irrigate it for the purpose of maturing its crop. Duty is stated with reference to a base period and the place of its reckoning or measurement. It is also called duty of water.

2.1.7 *Intensity of Irrigation* — The percentage of culturable commanded area proposed to be irrigated annually.

2.1.8 *Inundation Canal* — A canal taking off from a river in flood without a permanent diversion work.

2.1.9 *Main Canal* — The principal channel of a canal system off-taking from a river or a reservoir or tail reach of a feeder. Also called. 'main line'.

---

\*Glossary of terms relating to river valley projects: Part 1 Irrigation practice.

†Glossary of terms relating to river valley projects: Part 5 Canals.



**2.1.10 Permanent Canal** — A canal having a regular channel and masonry works for regulation and distribution, and with an assured source of supply.

**2.1.11 Side Slope Canal** — Canal aligned at right angles to the contours but not on a watershed or valley.

**NOTE** — Contour canals may irrigate only on one side and themselves from the upper boundaries of the irrigated area and cut across the natural drainage lines of the country. Watershed and side slope canals have the advantage of not interception any cross-drainage, but since they lie along the line of steepest possible slope, except in very flat area, only the smaller of the distributary canals may be so located.

**2.1.12 Water Allowance** — The outlets capacity in  $\text{m}^3/\text{s}$  authorized per thousand hectares of culturable commanded area.

**NOTE** — The water allowance, therefore, is the outcome of all considerations of duty of water, intensity, proposed crop ratio, water available, etc, and not only defines the size of outlet for each outlet area but also forms the basis for the design of the distributing canals in successive stages.

**2.1.13 Watershed Canal ( Ridge Canal )** -- Canal along any natural watershed.

### 3. PLANNING

**3.1** The first step in planning a canal system shall be to obtain daily flow data of the river at the headworks. In case the canal takes off from a reservoir project, it should be designed for a discharge which depends on live storage provided in the reservoir for irrigation and in case it takes off from a diversion work, it should be designed for 75 percent of the river discharge available as determined by flow duration curves. The flow duration curves should be prepared for crucial months at suitably close intervals. For canals taking off from diversion work, the study of discharge data shall determine the type of canal system to be planned and laid out, that is inundation canal, intermittent canal or permanent canal.

**3.2** After deciding the head discharge of canal, the area to be irrigated by canal system shall be worked out. This shall be done by preparing land use maps, preferably on a scale of 1 : 15 000, showing on them area already under cultivation, soil types, habitations, roads, drainages, and contours of the area. The intensity of irrigation to be provided on the project shall be decided after taking into account the socio-economic factors for the area and intensity of irrigation being achieved on other projects in the neighbourhood. The important crops of the area and their water requirements shall be determined in consultation with the department of agriculture and the agriculturists of the area proposed to be served allowing for the anticipated change in crop pattern due to introduction of wet farming in the area. Knowing thus the duty for various crops, the area under cultivation area under various crops, the intensity of irrigation, the

culturable area to be commanded shall be worked out and marked on the map. Areas that are higher and may not be supplied with flow irrigation should also be marked on the map and excluded from the culturable commanded area.

#### **4. DATA REQUIRED**

4.1 The following data is required for planning and layout of a canal system:

- a) Topographical map of the area,
- b) Subsurface data,
- c) Texture and salt composition of the soil,
- d) Soil characteristics including mechanical properties and shear parameters,
- e) Permeability of soil in relation to seepage loss,
- f) Rainfall data,
- g) Water availability,
- h) Subsoil water level in the area and quality of the underground water,
- j) Possibility of water logging and salination,
- k) Availability of suitable construction materials,
- m) Existing irrigation and drainage facilities,
- n) Existing crop patterns,
- p) Existing communication and transportation facilities, and
- q) Socio-economic study and agro-economic survey of the project area.

4.2 Adequate investigations shall be carried out to collect the data given in 4.1 by digging trial pits or bore holes, where necessary, to ascertain the nature of soil encountered along different alternative alignments.

4.5 For general guidance regarding the suitability of soils for use in canal embankments a reference may be made to IS :1498-1970\* and IS : 4701-1982?.

#### **5. CAPACITY**

5.1 Capacity of a canal system shall be fixed on the basis of the following considerations:

- a) Culturable commanded area,
- b) Water allowance ( see **2.1.12**), and
- c) Transmission losses.

---

\*Classification and identification of soils for general engineering **purposes** (*first revision*).

†Code **of practice for earthwork on canals** (*first revision*).

5.2 A capacity statement in the form shown in Appendix A shall be prepared to determine the capacity of the canal at control points.

## 6. ALIGNMENT

**6.1 Procedure** — Survey maps shall be prepared or produced preferably to a scale of 1 : 15 000 showing the contours, spot levels and important land features for the whole area to be developed.

6.1.1 Alignments of main canals, branches and distributaries shall be tentatively marked on the map ( *see* 6.1 ). A typical canal system may be generally represented as a main canal aligned as a contour canal and branches and distributaries aligned as watershed or side slope canals.

6.1.2 The main canal should be generally carried on a contour alignment, until either it commands the full area to be irrigated or it attains the top of a watershed. From such a point, it should be aligned down to the watershed ceasing to be a contour canal.

6.1.3 Branch canals and distributaries should take off from a **canal from** or near the points where the canal crosses watershed.

6.1.4 After reaching the watershed ( 6.1.2 ) the main canal should be located along the main watershed and branch canals along secondary watersheds **since** it is generally observed that the slope of the main watershed is less than the slope of the secondary watershed and the branches are required for irrigating the area up to the adjacent drainages on either side of the watershed crest.

6.2 The alignments of contour canals, especially in the upper reaches shall be decided after careful consideration of economy. Alternative alignments, their benefits and costs shall be compared.

6.3 While selecting the alignment, consideration of economy shall be born in mind. Deep cuttings or high embankments should be generally avoided by suitable detouring, after comparing the overall costs of the alternative alignments. Carrying of a canal in high embankment involves risk of branches from percolation. Careful judgement shall be exercised in fixing the points of crossing of drainage.

6.4 **Curves** — The alignments of canals shall consist of straight'lines with circular curves. Radii of curves should be usually 3 to 7 times the water surface width subject to the minimum given in Table 1.

6.5 **Spacing** — Distributaries may be spaced suitably depending upon the configuration of the area.

6.6 **Crossing** — It is desirable that alignment of a canal crosses least number of drainages.

**TABLE 1 RADII OF CURVES FOR CANALS**  
( Clause 6.4 )

UNLINED CANALS		LINED CANALS	
Discharge (1) m <sup>3</sup> /s	Radius, Min (2) m	Discharge (3) m <sup>3</sup> /s	Radius, Min (4) m
<b>80 and above</b>	<b>1 500</b>	<b>280 and above</b>	<b>900</b>
<b>Less than 80 to 30</b>	<b>1 000</b>	<b>Less than 280 to 200</b>	<b>750</b>
<b>Less „ 30 to 15</b>	<b>600</b>	<b>Less „ 200 „ 140</b>	<b>600</b>
<b>Less „ 15 to 3</b>	<b>300</b>	<b>Less „ 140 „ 70</b>	<b>450</b>
<b>Less „ 3 to 0'3</b>	<b>150</b>	<b>Less „ 70 „ 40</b>	<b>300</b>
<b>Less „ 0'3</b>	<b>90</b>	<b>Less „ 40 „ 10</b>	<b>200</b>
		<b>Less „ 10 „ 3</b>	<b>150</b>
		<b>Less „ 3 „ 0'3</b>	<b>100</b>
		<b>Less „ 0'3</b>	<b>50</b>

**NOTE 1** — The above radii are not applicable to unlined canals located in hilly reaches and highly permeable soils.

**NOTE 2** — On lined canals where the above radii may not be provided proper super-elevation shall be provided.

## 7. SURFACE AREA

**7.1** After the alignment of canals and drains is drawn in plan, areas served by various canals shall be calculated. The area depending on a branch/distributary canal shall generally be limited by the nearest drain.

## 8. FULL SUPPLY LEVELS

**8.1** After the tentative alignments of the canal system are marked, full supply levels shall be decided beginning with outlets, minors, distributaries, branch canals and then obtaining the full supply levels in main canal. This may be done by drawing longitudinal sections of main canal and its subsidiary canals. Longitudinal scale of about 1 : 10 000 to 1 : 20 000 and vertical scale of about 1 : 100 is recommended. The following information shall be added below the datum line on the longitudinal sections ( see Fig. 1 ):

- a) Natural surface level;
- b) Full supply level;
- c) Bed level;
- d) Subsoil water levels;
- e) Water surface slope;
- f) Bed widths; Value of 'N' side slope, F.S.D., F.S.Q. velocity;
- g) Free board; and
- h) Broad details of hydraulic data of outlets, regulators, bridges, drainage crossings, offtaking channels, etc.

## OTHER DATA TO BE INCORPORATED IN THE LONGITUDINAL SECTION

1. Test pit/auger hole data at every 500 m.
2. Location and data of offtaking channels/outlets.
3. Location and type of C. D. works along with hydraulic data of the drain, namely, Catchment Area, H. F. L., Design Discharge and Foundation data. Loss of head shall be indicated.
4. Location of Railway crossings with rail levels.
5. Location of other structures such as road bridges, cross regulators, escapes, falls, etc.

## DATA OF PARENT CANAL

### Upstream of Offtake

Bed Width = \_\_\_\_\_ Full Supply Depth = \_\_\_\_\_

Discharge = \_\_\_\_\_ m<sup>3</sup>/s

## DATA OF REGULATING WORK

At Reduced Distance = \_\_\_\_\_

Sill Level = \_\_\_\_\_ Throat Width = \_\_\_\_\_

**FIG. 1 TYPICAL L-SECTION OF A CANAL**

As in the Original Standard, this Page is Intentionally Left Blank

**8.2 Section and Slope** — The following principles should be kept in view for designing a canal system.

- a) The cross-sectional area of a canal should generally not increase from upstream to downstream;
- b) Cross-section of lined canals shall be designed in accordance with IS :10430-1982\* and IS :7112-1973†;
- c) A change in the hydraulic slope should generally not be introduced unless a control structure is placed in between; and
- d) Balancing depth shall be adopted, wherever possible.

**8.3 Structures** — In working out the longitudinal section, the provision of regulators, falls, escapes, cross drainage works, etc shall be considered. The losses shall be fully accounted for.

---

\*Criteria for design of lined canals and guidelines for selection of type of lining.

†Criteria for design of cross-section for unlined canals in alluvial soil.

# APPENDIX A

( Clause 5.2 )

## TYPICAL PROFORMA FOR CAPACITY STATEMENT OF A CANAL

12

Sl No.	Reach	
	From m	To m
(1)		
(2)		
(3)		
(4)	Length of reach, m (3) — (2)	
(5)	Name of offtake	
(6)	Reduced distance of offtake and side, ( L or R ), m	
(7)	Gross commanded area, Hectare	
(8)	Culturable commanded area ( C. C. A. ), Hectare	
(9)	Basic discharge per Hectare of C. C. A.	
(10)	Discharge at offtake head, $m^6/s$ (8) $\times$ (9)	
(11)	Discharge in the reach, $m^3/s$ , $\Sigma$ (10)	
(12)	Wetted perimeter, m	
(13)	Wetted area, $m^2$	
(14)	Rate of transmission losses*, $m^3/s/10^6m^2$	
(15)	Transmission losses (13) $\times$ (14)	
(16)	Total discharge in the reach, $m^3/s$ (11) + (15)	
(17)	Discharge at head of reach, $m^3/s$ [ Discharge at tail of reach + (16) ]	
(18)	Slope of reach, m/1 000 m	
(19)	Value of 'N' ( Rugosity coefficient )	
(20)	Bed width, m	
(21)	Full supply depth, m	
(22)	V ( velocity ), m/s	
(23)	Calculated discharge, $m^3/s$	
(24)	Remarks	

\*Transmission losses for lined canal shall be assumed as given in IS: 10430-1982 'Criteria for design of lined canals and guidelines for selection of type of lining'.



# BUREAU OF INDIAN STANDARDS

## Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones: 3 31 01 31, 3 31 13 75

Telegrams: Manaksanstha  
( Common to all Offices )

## Regional Offices:

Telephone

\*Western : Manakalaya, E9 MIDC, Marol, Andheri ( East ), 6 32 92 95  
BOMBAY 400093

†Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, 36 24 99  
Maniktola, CALCUTTA 700054

Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036 { 2 18 43  
3 16 41

Southern : C. I. T. Campus, MADRAS 600113 { 41 24 42  
41 25 19  
41 29 16

## Branch Offices:

'Pushpak', Nurmohamed Shaikh Marg, Khanpur, { 2 63 48  
AHMADABAD 380001 { 2 63 49

'F' Block, Unity Bldg, Narasimharaja Square, 22 48 05  
BANGALORE 560002

Gangotri Complex, 5th Floor, Bhadbhada Road, T. T. Nagar, 6 67 16  
BHOPAL 462003

Plot No. 82/83, Lewis Road, BHUBANESHWAR 751002 5 36 27

53/5, Ward No. 29, R. G. Barua Road, 5th Byelane  
GUWAHATI 781003 —

5-8-56C L. N. Gupta Marg (Nampally Station Road), 23 10 83  
HYDERABAD 500001

R14 Yudhister Marg, C Scheme, JAIPUR 302005 { 6 34 71  
6 98 32

117/418 B Sarvodaya Nagar, KANPUR 208005 { 21 68 76  
21 82 92

Patliputra Industrial Estate, PATNA 800013 6 23 05

Hantex Bldg ( 2nd Floor ), Railway Station Road, 7 66 37  
TRIVANDRUM 695001

## Inspection Offices ( With Sale Point ):

Pushpanjali, 205A West High Court Road, 2 51 71  
Bharampeth Extension, NAGPUR 440010

Institution of Engineers ( India ) Building, 1332 Shivaji Nagar, 5 24 35  
PUNE 411005

\*Sales Office in Bombay is at Novelty Chambers, Grant Road, 89 65 28  
Bombay 400007

†Sales Office in Calcutta is at 5 Chowringhee Approach, P. O. Princep 27 68 00  
Street, Calcutta 700072